

of plague itself, so that an epizootic has only to reach a certain intensity in order to bring about its own decline. It is difficult to estimate the decrease in rat population caused by an epizootic, but the systematic trapping carried out in the Punjab villages of Kasel and Dhand gave results which seem to indicate that this decrease may be considerable. An increase in the proportion of immune rats has a double action. First, it obviously connotes a decrease in the available number of susceptible rats; secondly, these immune rats actually protect their susceptible companions. For consider an infected flea which has just left a rat dead of plague. Such a flea is dangerous only so long as he carries living plague bacilli in his stomach. But the Commission has shown that the destruction of plague bacilli within the flea's stomach is largely effected by the activity of the rat's leucocytes, taken in at each fresh meal. But efficient phagocytosis depends on efficient opsonisation, so that if the infective flea chances to take a meal from an immune rat, the opsonic power of the blood of which is generally above normal, the phagocytic process will be hastened, and the flea will be less dangerous to his next susceptible host. This deduction was tested in an experiment in which fleas were first infected and then fed for twenty-four hours, one series on immune rats and another series on susceptible rats. The two lots of fleas were then allowed to feed on normal guinea-pigs, of which the immune-fed fleas infected only four out of eleven, while the others infected eight out of eleven. But we are led to expect further experiments on this interesting topic.

The number concludes with some brief remarks of the differential diagnosis of *B. pestis*. L. NOON.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—A course of eight lectures on "Algal Flagellates and the Lines of Algal Descent" will be begun by Dr. F. E. Fritsch at University College on October 26. During the second term a course of eight lectures on "Physical Chemistry and its Bearing on Biology" will be delivered by Dr. J. C. Philip, and in the third term a course of eight lectures on "Recent Advances in the Study of Heredity" will be delivered by Mr. A. D. Darbishire. A course of four lectures on "The Geological Structure of the Area of the Vosges" will be delivered at Bedford College by Miss C. A. Raisin, beginning on November 16, and in the second and third terms courses will be given at University College by Dr. A. Smith Woodward, F.R.S., and Prof. E. J. Garwood on, respectively, "The Use of Fossil Vertebrata in Stratigraphical Geology" and "The Geology and Physiography of Arctic Europe." Beginning on January 22, Dr. W. N. Shaw, F.R.S., will give a course of lectures on "The Climates of the British Possessions." On October 20 Dr. F. S. Locke will deliver, in the physiological laboratory of the University, a course of lectures on "Some Problems of General Physiology, more Particularly those Associated with Muscle," and in the second and third terms courses will be given by Prof. A. D. Waller, F.R.S., and Dr. A. Harden on, respectively, "General Physiology of Nerve" and "Chemical Biology of the Yeast Cell." On February 2 Dr. L. C. Parkes will begin, at University College, a course of four lectures on "The Medical Aspects of Recent Advances in Hygiene as Connected with Sewering." Prof. E. A. Minchin will in the third term give, at the Lister Institute, a course of lectures on protozoology, and in the first term Mr. R. Lydekker, F.R.S., will deliver three lectures on "The Living and Extinct Faunas of Africa and South America." Details as to the time and place of the delivery of the last-named course will be announced later. All the lectures referred to will be addressed to advanced students, and no charge will be made for admission.

University College.—The delivery of the following introductory public science lectures has been arranged for:—October 6, "Davy and Graham," by Sir William Ramsay, K.C.B., F.R.S.; October 8, "Personal Religion in Egypt," by Prof. W. M. Flinders Petrie, F.R.S.; October 8, "Gleanings in the Babylonian East," by Dr. T. G. Pinches; October 9, "Recent Developments in

Philosophic Thought," by Prof. G. Dawes Hicks; October 9, "School Hygiene," by Prof. H. R. Kenwood; October 14, "The Scientific Principles of Radioteleggraphy," by Prof. J. A. Fleming, F.R.S.

Bedford College.—A course of lectures and demonstrations for teachers, and persons qualifying to be teachers, will be given on "The Hygiene of Common Life," by Dr. J. S. Edkins. The opening lecture (the admission to which will be free) will be delivered on October 13.

OXFORD.—In a Convocation to be held on October 8 it will be proposed to confer the degree of Doctor of Science, *honoris causa*, upon Dr. Svante August Arrhenius and Dr. A. G. Vernon Harcourt, F.R.S.

MR. MATTHEW MONIE has been appointed lecturer on geology at the Glasgow Agricultural College.

DR. H. BYRON HEYWOOD has been appointed assistant lecturer in the mathematical department of the East London College.

THE general prospectus of the day and evening classes to be held at the Battersea Polytechnic during the session which has just begun provides careful guidance for intending students. New classes have been arranged for advanced students in hygiene, geology, and bacteriology, and new trade classes in wheelwrights' work and gas-fitting have been inaugurated. It is satisfactory also to find that coordinated courses have been drawn up in engineering, chemistry, physics, mathematics, and other main branches of work. A building grant from the London County Council has made it possible to set about extending the laboratories for mechanical and electrical engineering, and to undertake extensive alterations and additions in the chemistry department.

THE Board of Education has issued the following list of candidates successful in the competition for the Whitworth scholarships and exhibitions, 1908:—*I. Scholarships* (12*½* a year each, tenable for three years): W. H. Mead, Southsea; W. White, Portsmouth; W. H. Stock, Swindon; E. Bate, London. *II. Exhibitions* (50*l.*, tenable for one year): A. H. Gabb, Swindon; A. McKenzie, Devonport; R. Bassett, Devonport; S. L. Dawe, Devonport; A. J. Triggs, Devonport; A. C. Lowe, Harrogate; J. R. Pike, Portsmouth; H. R. Allison, Gillingham; A. E. Beal, Sheerness; C. R. Kemp, London; H. L. Guy, Penarth, Glamorgan; H. G. Stephens, Leicester; F. E. Rowett, Chatham; C. E. Haddy, Torpoint, R.S.O., Cornwall; W. E. Tong, Gosport; G. W. Bird, Plymouth; C. W. Limbourne, Plumstead; W. G. Pitt, Plumstead; E. J. Cox, Gosport; G. H. Reid, Stonehouse, Devon; D. Watson, Swindon; J. E. Burkhardt, Newcastle-on-Tyne; P. R. Higson, London; A. J. Sear, Portsmouth; E. O. Hale, Stantonbury, Bucks; F. C. Ham, Plumstead; A. R. C. Winn, Hornchurch, Essex; J. Scobie, London; F. Bray, Devonport; C. P. T. Lipscomb, Plumstead.

THE second section of the new buildings of the Glasgow and West of Scotland Technical College was used for the first time on Tuesday, September 22, on the occasion of admitting to the associateship of the college the students who had gained the college diploma at the close of last session. Dr. G. T. Beilby, F.R.S., chairman of the governors, presided at the meeting held in the examination hall, and in the course of an address described the relations of the college to the reform in methods of coal consumption. The college was the first institution in the United Kingdom to establish special laboratories for the teaching and study of everything connected with fuel and combustion. The most recent knowledge on these subjects shows that in the great majority of cases smoke and dust are quite unnecessary concomitants of industry. The inquiries of the recent Royal Commission on Coal Supplies have made it abundantly clear that the present inefficient consumption of coal in Great Britain not only leads to the waste of from forty to sixty million tons per annum, but that this inefficiency is also responsible for the greater proportion of the smoke and dirt from which the nation suffers. It has been estimated that on the total British consumption 30 per cent. might be saved if the best-known means of consumption for each purpose were employed. The college has as its most obvious duty the education

of specialists for the particular branches of industry which prevail in the district; but at the foundation of these industries there is one fundamental factor which affects each and all of them—they all depend ultimately on the combustion of coal for the production of light, heat, and power. Since the special laboratories were opened in connection with the Young chair of chemistry, Prof. Thomas Gray has carried out systematic instruction on the methods used for the scientific control of the combustion of coal and the economical utilisation of heat in factories. Not only are the regular students of chemistry, metallurgy, and engineering instructed in these methods as a necessary part of their curriculum, but similar instruction has been sought for and obtained by the members of the staff of a number of leading industrial concerns in the district.

SOCIETES AND ACADEMIES.

LONDON.

Royal Society, June 4.—“The Viscosity of Ice.” By R. M. Deeley. Communicated by Henry Woodward, F.R.S.

The rate of motion of a number of glaciers has been determined by Tyndall. From his figures and estimates of their thickness and slope it is possible to calculate with some degree of accuracy the viscosity of several glaciers. Stated in dynes per square centimetre $\times 10^{12}$, the results are roughly as follow:—the Mer de Glace, 27; Morteratsch, 143; Lower Grindelwald, 3; and Great Aletsch, 126. It seems probable that these differences arise mainly from differences in the actual viscosity of the glacier ice due to its varying granular structure. It is shown that the viscous flow of a glacier exercises a drag on the floor upon which it rests amounting in the case of the Great Aletsch to about $2\frac{1}{2}$ tons per square foot, and that owing to the ability of the ice to transmit thrust, this force may be greatly exceeded at points where much resistance to motion is caused by inequalities in the floor upon which the ice rests.

McConnel made a number of experiments on the shearing motion which can be produced in ice crystals in directions at right angles to the optic axis. It is shown that this shear obeys the laws of viscous motion, and that the viscosity may be expressed by the following equation:—

$$\log_{10} \mu = 0.301 + 153t - 0.00231t^2,$$

where μ is the viscosity in dynes per square centimetre $\times 10^{10}$, and t is the temperature below zero C. (considered positive). McConnel showed that when the load was taken off a bar of ice which had been yielding viscously, there was a slow partial recovery of the original form. Experiments with highly brittle pitch also showed that when the load was taken off a weighted bar there was an immediate elastic recovery, and also an additional slow recovery. This feature has also been described by Trouton.

The viscosity of ice at right angles to the optic axis is about 6250 times less than that of a glacier; the optic axis of glacier grains being at all angles, they lock each other. The motion of a glacier is due in a large measure to changes in the sizes and shapes of the glacier grains due to their growth and decay.

PARIS

Academy of Sciences, September 21.—M. Bouchard in the chair.—The determination of the triple orthogonal systems which comprise a family of cyclids, and, more generally, a family of surfaces with lines of curvature plane in the two systems: Gaston Darboux.—The use of tartar emetic in the treatment of trypanosomiasis: A. Laveran. Guinea-pigs infected with *T. evansi*, *T. gambiense*, and the trypanosome of Togo, were treated with hypodermic injections of a solution of sodium antimonyl tartrate in 2 per cent. solution. The results were generally favourable, especially when the antimony salt was used in conjunction with atoxyl.—The impossibility of demonstrating the existence of an appreciable dispersion of light in interstellar space by the Nordmann-Tikhoff method: Pierre Lebedew. The ratio of the dispersion

values found by Nordmann and by Tikhoff is 30:1, and the author concludes that a method of measurement which gives such different values for the same physical constant must be false in principle.—The spectra of the large planets photographed in 1907 at the Flagstaff Observatory: Percival Lowell. The principal lines and bands observed for Jupiter, Saturn, Uranus, and Neptune are tabulated. The presence of water vapour in the atmospheres of Jupiter and Saturn is proved, and also free hydrogen in Uranus and Neptune.—Reciprocal differences: E. Nörlund.—A lecture experiment concerning the rotation of the earth: Louis Maillard.—A particular form to which the differential equations of the trajectories of electrified corpuscles in a magnetic field can be reduced: C. Störmer.—The origin of the Brownian motion: Jean Perrin. Further experiments are described confirming the hypothesis that molecular agitation is the cause of the movement.—The thermoelectricity of cobalt: H. Pécheux. A study of a copper-cobalt thermocouple shows that molecular transformations occur in cobalt at 280° C. and 550° C.—Oleuropine, a new principle of glucoside nature extracted from the olive (*Olea europæa*): Em. Bourquelot and J. Vintilescu.—The function of the nervous system in the changes of colour in the frog: E. Sollaud.—The supposed action of tobacco in producing abortion: R. Robinson. Evidence is adduced negating this supposed action.—The cause of magnetic storms: K. Birkeland.

CONTENTS.

PAGE

Mathematical Aspects of Electricity and Magnetism. By Dr. C. Chree, F.R.S.	537
Petrels. By O. V. A.	538
Our Book Shelf:—	
Meyer: “Das Weltgebäude, Eine gemeinverständliche, Himmelskunde”	538
“Practical Coal Mining”	539
Letters to the Editor —	
Photographs of Comet c 1908 at the Royal Observatory, Greenwich.—Sir W. H. M. Christie, K.C.B., F.R.S.	539
Library Cooperation in Regard to Scientific Serials.—Dr. Thos. Muir, C.M.G., F.R.S.	539
Research Work on Natural Indigo.—T. R. Filgalt; Prof. R. Meldola, F.R.S.; C. Bergtheil	540
An Alleged Excretion of Toxic Substances by Plant Roots.—Howard S. Reed	540
Surveying for Archæologists. IV. (Illustrated.)	
By Sir Norman Lockyer, K.C.B., F.R.S.	542
The Horned Dinosaurs. (Illustrated.) By R. L.	544
Notes	545
Our Astronomical Column:—	
Comet Morehouse	549
Large Group of Sun-spots	550
The Orbit of ζ Cancri C	550
Search-ephemeris for Comet Tempel ₃ -Swift	550
The Manara Observatory	550
A Nebulous Field in Taurus	550
The Isothermal Layer of the Atmosphere	550
Third International Congress for the History of Religions	552
The British Association:—	
Section I.—Physiology.—Opening Address by J. S. Haldane, M.D., F.R.S., Fellow of New College and Reader in Physiology in the University of Oxford, President of the Section	553
Section K.—Botany. (With Diagrams.)—Opening Address by F. F. Blackman, M.A., D.Sc., F.R.S., President of the Section	556
The Scientific Study of Plague. By L. Noon	564
University and Educational Intelligence	565
Societies and Academies	566